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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte YUU INATOMI and MIKINARI SHIMADA

Appeal 2009-004018
Application 10/827,424
Technology Center 1700

Decided: November 24, 2009

Before BEVERLY A. FRANKLIN, MICHAEL P. COLAIANNI, and JEFFREY B. ROBERTSON, *Administrative Patent Judges*.

ROBERTSON, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

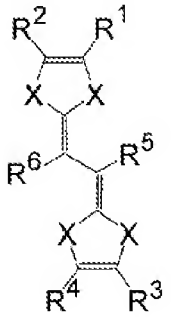
Appellants appeal under 35 U.S.C. § 134(a) from the Examiner's final rejection of claims 22, 25, 28, 32, 35, 38, 41, 44, 47, 50, and 53.[1] (App. Br. 2). We have jurisdiction pursuant to 35 U.S.C. § 6(b).

We AFFIRM.

THE INVENTION

Appellants describe a secondary battery comprising positive electrode, a negative electrode, and an electrolyte. Claim 32, reproduced below, is representative of the subject matter on appeal.

> 32. A secondary battery, comprising a positive electrode, a negative electrode and an electrolyte,
>
> wherein at least one of said positive electrode and said negative electrode includes an electrode active material comprising a compound having a structure represented by the general formula (1 a):



> where X is a sulfur atom or an oxygen atom; each of R^1 to R^4 is independently a linear or cyclic aliphatic group, a hydrogen atom, a hydroxyl group, a cyano group, an amino

[1] Claims 1-19, 21, 56, and 58 have been canceled and claims 20, 23, 24, 26, 27, 29-31, 33, 34, 36, 39, 40, 42, 43, 45, 46, 48, 49, 51, 52, 54, 55, and 57 have been withdrawn from consideration. (Appeal Brief filed June 11, 2008, hereinafter "App. Br.," 2). Neither the Appellants nor the Examiner address the status of claim 54. However, according to the record, claim 54 also has been withdrawn from consideration. (*See* Non-Final Action mailed March 26, 2007.)

group, a nitro group or a nitroso group; each of R^5 and R^6 is independently a linear or cyclic aliphatic group, or a hydrogen atom; said aliphatic group includes at least one selected from the group consisting of an oxygen atom, a nitrogen atom, a sulfur atom, a silicon atom, a phosphorus atom, a boron atom, and a halogen atom.

THE REJECTION

The prior art relied upon by the Examiner in rejecting the claims on appeal is:

Wurmb	US 4,092,463	May 30, 1978
Beck	US 4,119,767	Oct. 10, 1978
Di Salvo, Jr.	US 4,198,476	Apr. 15, 1980
Christian	US 4,228,226	Oct. 14, 1980
D'Agostino	US 4,414,090	Nov. 8, 1983
Gifford	US 4,463,072	Jul. 31, 1984
Naarmann	US 4,535,039	Aug. 13, 1985
Ando	US 4,652,504	Mar. 24, 1987
Varma	US 4,687,598	Aug. 18, 1987
Hiratsuka	US 4,702,977	Oct. 27, 1987
Ross, Jr.	US 4,842,963	Jun. 27, 1989
Zhang	US 6,110, 619	Aug. 29, 2000

Carlier, R. "Electrosynthesis and redox behavior of vinylogous TTF displaying strong conformational changes associated with electron transfers" Electrochimica Acta 46 (2001) 3269-3277.

L.G. Wade, Jr. "Organic Chemistry" Fourth Edition, Chapter 1, pp. 1-2.

The Examiner rejected claims 22, 25, 28, 32, 35, 38, 41, 44, 47, 50, and 53 under 35 U.S.C. § 103(a) as being unpatentable over Zhang in view of Carlier.

The Examiner found that Zhang discloses secondary batteries containing organo-sulfur structures, but that Zhang fails to disclose the compound represented by formula (1a) recited in the claims. (Examiner's Answer entered July 28, 2008, hereinafter "Ans.," 4). The Examiner found that Carlier discloses the recited compounds containing sulfur, which induce fast electron transfer and can control the relative stabilities of different redox species. (Ans. 4-5). The Examiner concluded that it would have been obvious to substitute the compounds disclosed in Carlier into the secondary batteries of Zhang in order to increase the electroconductivity. (Ans. 5).

Appellants contend that the Carlier's compounds do not fall within the definition of organic-sulfur materials disclosed in Zhang, which contain only single or double carbon-sulfur or sulfur-sulfur bonds. (App. Br. 4). Appellants also argue that Zhang discloses that organo-sulfur compounds such as those disclosed in Carlier have reduced utility as cathode materials because they contain less than 50% by weight sulfur. (App. Br. 5). Appellants contend that Zhang discloses that electrochemical activity involves forming and breaking S-S bonds and that Carlier's compounds have no S-S bonds. (App. Br. 5; Reply Brief filed September 29, 2008, hereinafter "Rep. Br.," 8-9). Accordingly Appellants argue that Zhang teaches away from using Carlier's compounds in secondary batteries and that employing Carlier's compounds in Zhang's batteries would render Zhang's batteries inoperable. (App. Br. 5-6).

ISSUE

Based on Appellants' contentions, an issue on appeal is: have Appellants shown that the Examiner reversibly erred in determining that it

would have been obvious to substitute Carlier's compounds for the organic-sulfur materials in Zhang's secondary batteries?

FINDINGS OF FACT

The record supports the following findings of fact (FF) by a preponderance of the evidence.

1. Zhang discloses that sulfur is highly desirable as an electrochemically active material in secondary batteries due to the high energy density provided and that the sulfur can be present as an organic material "with a high sulfur content, preferably greater than 50 weight percent sulfur." (Col. 1, ll. 38-52).
2. Zhang states "[h]erein, the term 'organo-sulfur materials' means a material containing organic sulfur compounds with only single or double carbon-sulfur bonds or sulfur-sulfur bonds forming disulfide linkages." (Col. 2, ll. 52-55).
3. Zhang states "the organo-sulfur materials typically contain less than 50 weight percent of sulfur and have only electroactive disulfide (-S-S-) bonds so they have a much lower energy density or specific capacity than elemental sulfur." (Col. 3, ll. 10-15).
4. Zhang discloses that electroactive sulfur-containing materials include polymeric materials having carbocyclic repeat groups. (Col. 11, ll. 21-31).
5. Carlier discloses compounds corresponding to Appellants' general formula 1 containing sulfur, which exhibit fast electron transfer and redox behavior. (Abstract, p. 3272, section 3.2 right column, Scheme 4).

PRINCIPLES OF LAW

"The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *KSR Int'l. Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007).

> A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant. The degree of teaching away will of course depend on the particular facts; in general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant.

In re Gurley, 27 F.3d 551, 553 (Fed. Cir. 1994). In determining whether prior art references teach away from the claimed combination, the nature of the teachings is highly relevant. *Id.*

ANALYSIS

Appellants have not separately grouped the claims on appeal. Accordingly, we confine our discussion to appealed claim 32, which contains claim limitations representative of the arguments made by Appellants pursuant to 37 C.F.R. § 41.37(c)(1)(vii).[2]

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[2] Only those arguments actually made by Appellants have been considered in this decision. Arguments which Appellants could have made but chose not to make have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii) (2009).

Appellants have failed to demonstrate that one of ordinary skill in the art would not have achieved predictable results in applying Carlier's compound as the electrochemically active materials in Zhang's secondary batteries. Zhang discloses that sulfur-containing compounds are highly desirable for electrochemically active materials in secondary batteries. (FF 1). In addition, Zhang discloses that electroactive sulfur-containing materials may additionally contain carbocyclic groups. (FF 4). Thus, because Zhang discloses other embodiments for the electroactive sulfur-containing materials, one of ordinary skill in the art would have recognized that Zhang is not limited to those electroactive sulfur-containing materials only containing carbon-sulfur and sulfur-sulfur bonds. (*See* FF 2). Appellants do not dispute the Examiner's position that Carlier discloses electrochemically active materials. (*See* FF 5). Thus, one of ordinary skill in the art would have reasonably expected that Carlier's compounds would be effective in Zhang's secondary batteries. (*See* Ans. 6-7).

Further, we are not persuaded that Zhang teaches away from employing Carlier's compounds in secondary batteries. Although Zhang discloses electrochemical activity based on forming and breaking S-S covalent bonds, Zhang does not criticize other electrochemically active compounds, such as Carlier's compounds, which may exhibit electrochemical activity based on other means than by forming and breaking S-S covalent bonds.

Moreover, Zhang's disclosure regarding organo-sulfur materials containing less than 50 weight percent sulfur (FF 3) does not amount to a teaching away from applying Carlier's compounds in the manner suggested by the Examiner. Zhang specifically refers to organo-sulfur materials

containing sulfur-sulfur bonds, and therefore Zhang's disclosure does not apply to Carlier's compounds, which do not contain sulfur-sulfur bonds. Thus, Zhang does not teach away from applying Carlier's compounds in secondary batteries. Accordingly, Appellants have failed to demonstrate that applying Carlier's compounds in Zhang's secondary batteries would not produce predictable results.

CONCLUSION

Appellants have failed to demonstrate that the Examiner reversibly erred in determining that it would have been obvious to substitute Carlier's compounds for the organic-sulfur materials in Zhang's secondary batteries.

ORDER

We affirm the Examiner's decision rejecting claims 22, 25, 28, 32, 35, 38, 41, 44, 47, 50, and 53 under 35 U.S.C. § 103(a) as being unpatentable over Zhang in view of Carlier.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. §1.136(a)(1)(iv).

AFFIRMED

PL initial:
sld

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